

Fit Freshmen:  
A mixed methods approach to developing weight control strategies for 1st year college  
students

Kerry Lynn Potter

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Paul A. Estabrooks, PhD, Chair  
Brenda M. Davy, PhD, RD  
Kevin P. Davy, PhD  
Jennie L. Hill, PhD  
Kerry J. Redican, PhD

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ABSTRACT

College-age adults gain weight more rapidly than the general population, with a mean weight gain of ~1.8 to 4 kilograms during their first year at college. The purpose of this pilot RCT was to test the efficacy of a semester long internet weight-loss program based upon social cognitive theory for overweight college freshmen. Qualitative focus groups were used to provide feedback on content of the active intervention. Participants (n=27; m<sub>age</sub>=18.5±.6; m<sub>weight</sub>=90kg±18; 74% female) were randomly assigned to the active intervention (Fit Freshmen; FF) or a health information control group and completed baseline and 3 month follow-up measurements. When compared to controls FF participants experienced higher improvement in self-regulatory skills for portion control, fruit and vegetable consumption and physical activity (all p's<.05). Consumption of dietary fat and added sugar also decreased significantly for FF subjects when compared to controls (all p's<.05) while total energy intake differences were significant (p<.09). Trends in increased physical activity were present, but not significantly different between groups. Finally, FF lost significantly more weight than controls (m<sub>difference</sub>=2.2kg; p<0.05) and more fat mass (m<sub>difference</sub>=1kg; p<0.09). Themes for content improvement included providing a more detailed meal plan, reducing email contact, and increasing social activity opportunities. Program characteristics that were positively evaluated included the flexible exercise program, incentives for weight loss, and use of an onsite weigh station. This study provides promising outcomes for a scalable internet-based weight loss

program for college freshmen and highlights features that could be improved to be more attractive to this population.

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“Be Swift, Don't Whine, Try Your Hardest”

## Table of Contents

Abstract	ii
Acknowledgements	iv
Table of Contents	v
List of Tables	vii
List of Figures	viii
<b>Chapter 1: Introduction</b>	<b>1</b>
a) Specific Aims	
<b>Chapter 2: Literature Review</b>	<b>5</b>
a) Obesity Incidence in Young Adults	
b) Barriers for Weight Loss Interventions for College Students	
c) The Use of the Internet as a Medium for Weight Loss Interventions	
d) Summary	
<b>Chapter 3: Methods</b>	<b>12</b>
a) Procedures	
i) Recruitment & Participants	
ii) Data Collection	
b) Measures	
i) Anthropometric Measures	
ii) Eating Attitudes Test (EAT-26)	
iii) Dietary Intake	
iv) Physical Activity	
v) Psychosocial Measures	
c) Intervention development and delivery	
i) Fit Freshmen Program	
ii) Control	
d) Focus Groups	
e) Data Analysis	
<b>Chapter 4: Results</b>	<b>24</b>
a) Dietary Behaviors	
b) Physical Activity Behaviors	
c) Diet and Physical Activity Social Cognitive Related Constructs	
d) Qualitative Analysis	

<b>Chapter 5: Discussion</b>	30
a) Qualitative Data	
b) Limitations	
<b>Chapter 6: Conclusions</b>	40
<b>References</b>	42
<b>Appendices: Appendix A – Institutional Review Board Full Approval (Fit Freshman)</b>	56
<b>Appendix B – Health History Screener</b>	57
<b>Appendix C – Fit Freshmen Focus Group Guide</b>	61
<b>Appendix D – Contamination Between Groups Questionnaire</b>	63
<b>Appendix E – Fit Freshmen Program Experience Evaluation</b>	64

## List of Tables

<b>Table 1:</b>	Baseline characteristics by condition	48
<b>Table 2:</b>	Quantitative Outcomes of Fit Freshmen Pilot RCT	49
<b>Table 3:</b>	Correlations between social cognitive psychosocial mediators, PA, dietary intake, and weight loss	53

## List of Figures

**Figure 1:** Consort Diagram

55

# CHAPTER 1

## Introduction

### Specific Aims

Obesity is the seventh leading cause of death in the world (1). Recent research has shown that a prevalent time for weight gain is young adulthood (18 to 29 years) (2). Most American young adults gain on average 0.8 kilograms per year (3). The majority of this weight gain occurs in the early 20s and then levels off (3). The college-aged population is particularly susceptible to weight gain, experiencing a mean weight gain of 1.8 to 4 kilograms during their first year of college (3). In addition, women living on campus, such as a dormitory, gain weight 36 times faster compared to women of the same age not living on-campus (4). However, there is little data examining weight management programs within a university-living environment. Although research has demonstrated that weight loss programs are effective in older adults (5), these programs may not translate to younger populations such as college-aged students, who deal with different motives and barriers such as demands on time, financial issues, as well as peer and academic pressure (6-8).

Prior studies have reported that students' positive health behaviors such as healthful eating and regular exercise often decline upon entering college (9-11). Students reported less physical activity in college as compared to high school, and increased consumption of high-calorie foods from fast food restaurants and vending machines (9-11). Further, weight loss programs targeting college students are unsuccessful when they target only physical activity or nutrition, do not include behavioral strategies, or address population specific barriers and motives (11-13). In addition, a qualitative analysis of college student preferences for different

weight loss strategies included the provision of incentives (16) and other literature documents that social cognitive factors such as goal setting, planning, self-monitoring, and self-efficacy play a significant role in preventing weight gain in college students and could be incorporated into health promotion programs in a college setting (14, 15). Additionally, behavioral skills such as planning and tracking were associated with lower energy intake as well as increased fruit and vegetable consumption (11). Unfortunately, college students report that they rarely use dietary strategies to regulate and track food intake and only occasionally use them to incorporate more fruit and vegetables into daily food intake (11). Thus, it could be hypothesized that social cognitive theory (SCT)-based interventions may be used in this population to address psychosocial mediators of physical activity, healthful eating, and weight gain.

Given the well documented time demands related with the transition from high school to college, the channel of delivery of interventions for college freshmen is an important consideration. One area of promise is Internet-based weight loss interventions (16, 17). There is support for the positive effects of Internet-based programs to address a wide range of health behaviors including weight loss (18, 19). In an university setting where Internet use is ubiquitous, this may be an effective medium for tailored weight-loss program delivery and improve reach among college students (20).

The general goal of this pilot study was to address the gaps in the literature addressing effective weight loss strategies in overweight/obese college freshmen. Specifically, the purpose of this pilot mixed methods randomized controlled trial was to determine if an Internet and incentives based weight loss program can achieve significant weight loss in a sample of college freshmen over a 3 month period. A second goal was to determine if the experimental condition also lead to superior improvements in proposed psychosocial mediators of physical activity and

eating behavior change. Finally, due to the pilot nature of the study and the small sample size, a full test of mediation is beyond the scope of this trial however, a third goal of the study was to understand the perceptions of the participants who were randomly assigned to the experimental condition, using structured focus groups, to elicit feedback on the program content and structure. Thus, this study, which was approved by the Virginia Tech Institutional Review Board, included the following primary aims. To determine:

- (a) if an Internet and incentive-based behavioral weight loss program will produce significant weight loss over a 3-month period in comparison to a control group receiving 2 general health newsletters

Hypothesis: The Internet and incentives-based behavioral program would lead to significant weight loss in participants in comparison to those assigned to the basic nutrition and exercise informational newsletters.

- (b) specific themes related to the feasibility and acceptability of the Internet and incentives-based program from the perspective of participating college freshmen

Hypothesis: The focus group will indicate that the incentive component of the intervention is appealing and will suggestion modifications to enhance acceptability to the target population of college freshmen.

Due to the small sample size and the variability typically associated with psychosocial measures and self-reported methods to assess physical activity and dietary intake behavior change the following aims are considered secondary:

- (a) To determine if an Internet and incentives-based behavioral weight loss program will produce significant improvements in targeted psychosocial mediators of physical activity and nutrition behavior changes over a 3-month period in comparison to controls

Hypothesis: Improvements in social cognitions will be greater for participants in the experimental condition when compared to those in the control condition.

- (b) To determine the effects of the Internet and incentives-based behavioral weight loss program on physical activity and dietary intake.

Hypothesis: Improvements in physical activity and dietary intake would be greater for participants in the experimental condition when compared to those in the control condition.

- (c) To examine the relationships between changes in proposed psychosocial mediators, physical activity & dietary intake, and weight loss.

Hypothesis: Changes in psychosocial mediators, physical activity, dietary intake, and weight-loss will be correlated, but the magnitude of the correlations—when considering the sample size—may not be sufficient to be significant.

## CHAPTER 2

### Literature Review

***Obesity Incidence in Young Adults*** – The onset of overweight and obesity is continually starting earlier in later birth cohorts (2). According to the National Longitudinal Survey of Youth 1979, a prospective cohort study, over 25% of the United States population is obese by age 35 (2). Other cohort studies confirm this trend of the prevalence of weight gain being greatest in an individual's 20's (21). Not only are overweight adolescents more likely to become obese adults, they are also at risk for several comorbidities such as hypertension, dyslipidemia, type 2 diabetes, depression and low self-esteem (22, 23). Hill et al. estimated that young adults between the age of 20 to 40 years old gain on average between 0.8 to 0.9 kilograms per year (24). However, the environment seems to play an important role in average yearly weight gain seen in young adults. Specifically, young adults attending college gain an average of 2kg – 4kg of body weight during their first year of college (25). Yet, contributions to young adult weight gain vary and are inconsistent (25). A higher initial BMI and low-frequency of baseline physical activity when entering college is associated with more weight gain in the first semester of college (26). Furthermore, trends show an increased intake of alcohol, decreased intake of fruits and vegetables and no change in the amount of daily physical activity among college freshmen (26).

***Barriers for Weight Loss Interventions for College Students*** – Although a number of studies have investigated the causes of weight gain in college students and young adults, current interventions targeted towards this population seem to be ineffective. For example, in a study by Jeffery and French (27), a low-intensity intervention targeting mainly low-income young women was unsuccessful when compared to a control in reducing weight gain over a three year period. The two intervention groups, one consisting of monthly educational newsletters delivered via

mail and the other with an additional \$100 monthly lottery drawing incentive were not successful in reducing weight gain. However, the authors concluded that there were several key messages to take from this intervention for future research including: (1) increasing the frequency of messages, (2) using more interactive formats, and (3) tailoring the intervention to individual needs (27). Matvienko and colleagues used a similar type of intervention on college freshmen and sophomore women and were unsuccessful in preventing weight gain (28). The intervention group included a nutrition course that stressed basic principles of human physiology, energy metabolism, and genetics in order to help prevent weight gain in the first 16 months of an individual's college experience (28). The course lacked a behavioral component, formal social support strategies, or information on how to lose weight through diet and PA. The intervention was successful in increasing nutrition knowledge; however there was no main effect for condition by time for BMI or weight at the end of the study or follow-up. Still, the intervention had a profound effect on the subgroup of students who were considered overweight and obese by BMI standards. Students of higher BMI in the intervention group lost 1.4 kilograms over the 16 months while the higher BMI subjects in the control gained an average of 9 kilograms. However, the analyses of overweight participants included only 6 control participants and 11 intervention participants. Additionally, the 6 control participants gained on average over 9 kilograms, well over the typical 3.1 – 3.4 kg of weight gain seen in this population (25), which brings into question the representativeness of this subsample. These studies suggest that a less-frequent, low-intensity and knowledge-only approaches are not effective in changing health behaviors or in preventing weight gain in the college population.

Further, the role of physical activity in weight loss during college is unclear. In most freshmen weight gain prevention or weight loss studies, physical activity is not assessed as an

outcome (25). In the few studies that have assessed PA in college students, there was a lack of experimental designs (25). In a meta-analysis conducted by Keating et al. 40 to 50% of college students were shown to be inactive with regards to physical activity (29). Furthermore, researchers found that 81% of college seniors who were inactive maintained a sedentary lifestyle into adulthood in comparison to 84.7% of active college seniors maintaining a physically active lifestyle for the following 10 years (30). According to Keating et al., the current problem with studies focusing on physical activity in college students includes inconsistent measurements of PA, an inability to understand overall PA patterns in this population, and weak intervention designs that fail to change PA habits in college students (29). However, researchers have investigated many cognitive determinants in relation to PA in college students (29). One important variable in determining PA behaviors is self-efficacy. In this population, high self-efficacy is consistently related to high levels of PA (29). Thus, while the contribution of physical activity to college student weight gain or loss has received relatively little study, future research in the area should target social cognitive theory variables such as self-efficacy to promote physical activity as a component of a weight loss program.

One promising area of intervention to address weight loss in college students is the use of behavioral strategies. For example, Eiben and Lissner (31) showed that an intervention with an individualized behavioral program focusing on food choice, PA and other lifestyle factors prevented weight gain or initiated weight loss in women 18–28 years old, when compared to a control group that only received the information via Internet without a behavioral component. However, due to the small sample size and only use of women, this information may not be generalized to all young adults or to college students specifically. Another limitation of this study was the wide range of changes of body weight that was observed among the participants

which lead the authors to conclude that there may have been a heavy influence of outliers (31). Still, other weight loss and weight gain prevention interventions that have used a college population with a behavioral component have shown to be successful (14).

Hivert et al. developed a successful behavioral intervention delivered to college freshmen (14). Fifty-eight college freshmen participated in a two-year intervention that included 45 minute seminars delivered twice a week for the first two months of academic calendar and once every month thereafter for the remainder of the intervention. Seminars were aimed at increasing knowledge on weight gain, national dietary and exercise recommendations as well as introducing behavioral modification methods using discussion on problem-solving, goal-setting and monitoring strategies relevant to this population. After the 2 year intervention period, participants in the no-contact control group had gained weight while those in the seminar intervention lost weight (difference of 1.3kg).

In contrast, Calfas et al. did not see significant results when conducting a two-year RCT PA intervention with a behavioral component among seniors in college entering the workforce. (13). Project GRAD promoted adoption and maintenance of physical activity among young adults transitioning from university to adult roles through a semester-long college course and an 18-month follow up period during which participants were phoned or mailed materials reminding them to be active. The behavioral science component of the intervention was based on the Transtheoretical Model and Social Cognitive Theory and targeted (1) self-efficacy, (2) social support; (3) outcome expectations, (4) barriers to changing behavior; (5) enjoyment of the behavior; and (6) use of experiential and behavioral processes of change. There were no significant intervention effects on physical activity outcomes at 2 years for either men or women. However, it is to be noted that the authors concluded that the follow-up intervention was not

sufficiently intensive, as follow-up calls were made monthly for only the first six months (13). Therefore, future interventions should increase frequency of contacts to reinforce health-related behaviors to be maintained for an extended period of time.

The limited published research on weight loss and maintenance in college students as well as interventions including self-regulatory behavioral training that reach a wide audience in this target population suggests that it is necessary to address knowledge and self-regulatory behavioral training if a weight management intervention will be successful and that there is a need for intensive approaches (i.e., high frequency and duration of intervention sessions).

***The Use of the Internet as a Medium for Weight Loss Interventions*** - Researchers have not addressed the potential reach of different weight loss intervention strategies or the best channel for intervention delivery in to reach this target population (32). Due to an estimated 25% of the world's population having access to the Internet in 2009 and respectively 75% in North America, the Internet is increasingly used as a medium for the delivery of health behavior interventions (33) and may be promising for college student interventions (34) Further, a recent review found that Internet-based interventions with more extensive behavioral theory foundations were associated with larger effect sizes (33). The review also found that in addition to delivery through the Internet, health behavior interventions that included supplementary modes such as text messages, additional motivational emails, and use of communicative functions, especially access to an advisor to request advice, also tended to be highly effective and informative (33). Thus, in addition to the Internet as a suitable medium for delivering interventions, personal contact via email, online, or text message may help to support behavior change (33). More specifically focusing on weight loss programs in a younger population, web-based weight management programs in overweight children and adolescent populations ranging

from 8 to 18 years old in the United States showed the potential for Internet-based weight loss programs to be effective in weight loss and sustained weight maintenance (16).

In a recent randomized controlled study (35), phone and email-counseling with behavioral messages were effective in producing significant reduction in body weight in overweight adults in comparison to a control group receiving self-help materials over a 6-month period (35). In 2006, Rothert and colleagues published findings from a randomized controlled trial testing the efficacy of Internet-based weight loss programs. Overweight and obese participants from four regions of Kaiser Permanente's health care delivery system were randomized to receive either a tailored expert system called the "Balance Program" or information-only Web-based weight management materials. Participants in the "Balance Program" had significantly greater weight loss at follow-up (3% of baseline weight) compared to the information-only condition (1.2% of baseline weight). The Balance Program did not recommend a specific diet, but instead focused on a healthy diet, behavioral and social cues to eating, PA, a better understanding of the relationship between food consumption and energy expenditure, calorie and fat consumption, attributions for previous weight management efforts, body image, and social support. Also to be noted is the large and diverse sample that was reached through a completely web-based intervention. Findings from this study suggest that tailoring web-based weight loss and management programs to target populations may be more effective, reachable and cost-effective.

Web-based weight management programs have the potential to reach millions of individuals at a relatively low cost (36). Moreover, the Internet offers significant advantages over print-based tailored materials in the interactivity and vividness of data collection and feedback. However it is to be noted that web-based weight loss programs are more effective when they

incorporate existing research and theory-based applications in comparison to commercial based weight loss programs lacking these features (36, 37).

From the current body of research about the use of Internet in health behavior programs and the need for health behavior programs incorporating social cognitive constructs geared towards college students, it is surprising that there are not more interventions created using these suggestions. This age group's high rates of Internet use indicate that Internet as a weight loss program medium is promising method for delivery in a university setting (38).

*Summary* - Common themes have been cited among college students that are seen as barriers to weight loss including intrapersonal, interpersonal and environmental barriers (12). Common intrapersonal barriers include lack of motivation to exercise, not eating healthful foods, stress and boredom. Interpersonal barriers included pressure from social situations and lack of social support to either exercise or eat healthy and not drink alcohol. Environmental barriers included time constraints due to studies, ready access to unhealthful food and lack of access to healthful food at on-campus dining halls, high costs associated with buying healthful foods (12). Hence, interventions targeting weight loss in this population should target improved motivation, strategies to support healthy food choices, take little time, and include social support. However, the current literature does not provide information on the way such strategies could be effectively integrated into a university setting or address the broader social and physical environment that is unique to college students (11, 39).

## CHAPTER 3

### Methods

#### Procedures

This pilot study was designed as a randomized controlled trial including both quantitative and qualitative data collection. Participants were recruited from the 2009 Virginia Tech Freshmen class. The Institutional Review Board at Virginia Tech University approved all study activities and participants provided informed consent before participating in the investigation.

#### *Recruitment & Participants*

Recruitment lasted for 3 weeks at the beginning of the spring semester after winter vacation via ads run in the University newspapers, flyers, as well as announcements made through general education classes occupied mainly by freshmen students. Eligible participants were first time college freshmen, at least 18 years of age, had a BMI > 25, were not pregnant or pregnant in the last 12 months, and free from eating disorder symptoms. The Eating Attitudes Test (EAT-26) was used to assess symptoms of disordered eating and students with a score > 20 on the EAT-26 were excluded from the study (40). Additionally, students who had a known chronic disease such as diabetes, lung disease, heart disease or a thyroid disorder were excluded because of the potential risk in not meeting the needs of a special population through a generalized diet prescription and exercise regimen.

Of those who responded to recruitment (n=77), 33 were ineligible due to a BMI < 25, six were ineligible based on EAT-26 scores and 3 were not current freshmen (See Figure 1). Of the 35 eligible individuals, six students declined due to time constraints and lack of interest. Twenty nine individuals were initially randomized to the active intervention, Fit Freshmen, or control

group, and twenty seven individuals completed the entire study. Participants, on average, were 18 years old and predominantly white (24 white, 1 African American, 3 Asian, 1 American Indian). Seventy-six percent of the participants were female. At baseline, the average weight of the sample was 90.3kg and BMI of 30.97.

### Data collection

Eligible participants completed a series of questionnaires and laboratory-based measurements including a survey, body weight measurement, waist circumference and DEXA scan. Participant assessments collected at baseline and 3 months included laboratory measurements (weight, height, & waist circumference) and survey instruments included a Health Belief Survey, Godin's Lesiure Time Questionnaire, and analysis of 4-day food records. DEXA measurements for body fat percentage, absolute fat mass and fat-free mass were collected at baseline and 3 months. Follow up assessments that mirrored the baseline measures were completed approximately 3 months after baseline. Following completion of baseline measurements, participants were randomly assigned to either an informational control group (n=15) or the Fit Freshmen active intervention group (n=14). Participants were paid \$10 upon completion of baseline and 3-month measurements.

Focus groups to determine program feasibility and acceptability were completed after the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> month of intervention. Participants in the experimental intervention were randomly selected to participate in the focus groups and no participants attended more than one focus group. Each participant was paid \$20 upon completion of a focus group.

### **Measures**

Basic sociodemographic information and medical history were collected at baseline.

### Anthropometric Measures.

Height was measured in inches without shoes using a wall-mounted stadiometer. Body weight was assessed to the nearest 0.1 kg using a digital scale calibrated for accuracy prior to each assessment period. A research assistant blinded to the participants' treatment status administered the weighing to ensure accuracy. Body mass index was calculated as  $\text{weight(kg)/height(m)}^2$ . Waist circumference was measured to the nearest 0.5cm using a Gulick tape measure at the level of the umbilicus. Body fat percentage, absolute fat mass and fat-free mass were measured using dual energy X-ray absorptiometry (DEXA).

### Eating Attitudes Test (EAT- 26).

The EAT-26 is an objective, self-report measure that was used as a screener for symptoms of disordered eating (40). A cut-off score of 20 on the EAT-26 distinguishes individuals with disordered eating (admin time = 10 mins). This test was not administered at the conclusion of the intervention.

### Dietary Intake.

To assess habitual energy intake, participants were instructed in proper methods to record their food intake and provided with two-dimensional food models to assist in accurate portion size determination. The recall covered four consecutive days, including three weekdays and one weekend day. Records were reviewed for accuracy and completeness upon their return and analyzed using diet analysis software (NDS-R 4.05, University of Minnesota, Minneapolis, MN).

### Physical Activity.

Habitual physical activity (PA) was measured using Godin's Leisure Time Exercise Questionnaire at each assessment point throughout the intervention (41, 42). Self-reported measures were used to assess PA because they are easy to administer and relatively inexpensive.

The questionnaire assesses time and intensity of physical activity by evaluating weekly minutes and days spent doing mild, moderate and vigorous exercise as well as strength training. The scales were scored based upon published protocols (42-44).

### Psychosocial Measures.

Psychosocial measures associated with physical activity, dietary intake and weight loss in a college-aged population are assessed with the Health Beliefs Survey (45). This survey was developed to operationalize SCT variables (46). The Health Beliefs Survey is designed to assess Social Cognitive Theory (SCT) determinants of eating behaviors and for physical activity behaviors using a 5 point Likert scale (1=never to 5=always.) (45). This 102-item survey consists of measures of self-efficacy, outcome expectations, and self-regulation for both PA and nutrition. It was proposed that the casual mediator mechanisms of intervention effectiveness would include (1) self-efficacy, (2) outcome expectations, and (3) self regulation strategies. The scales used for the Health Beliefs Survey had appropriate internal consistency (Cronbach's  $\alpha=.68-.90$ ) and have been previously show to be predictive of physical activity (47) and dietary intake (48). Self-regulation strategies were measured using 26-items and were further divided into subcategories (self-regulation regarding planning and tracking; keeping track; portion sizes; dietary behaviors; and PA). Participants were asked to rate on a 5-point Likert-scale (1=never to 5=always) how often in the past 3 months they used strategies to regulate certain health behaviors. Examples of questions included "How often did you plan to eat smaller portion sizes at meals?" Self-efficacy regarding dietary behaviors was measured with 10-items and rated on a scale from 0 to 100 (0=Certain I cannot to 100=Certain I can). Participants were asked to rate how often, every day; they could incorporate and keep track of the healthful foods such as fruits and vegetables that they incorporate into their daily diet. Self-efficacy regarding PA was

measured using 17-items and was also rated on a scale from 0 to 100 (0=Certain I cannot to 100=Certain I can) and prompted participants to respond to how certain they could exercise in different situations. Example questions included “exercise most days of the week” and “find a place to exercise during bad weather”. Positive and negative outcome expectations for fruit and vegetable consumption was measured with 22-items that asked participants to use a 5-point Likert-type scale (1=strongly disagree to 5=strongly agree) to rate how much they agreed that certain outcomes would happen such as “I will have more energy” or “I will lose weight”. Positive and negative outcome expectations related to PA were measured with 27-items that asked participants to use a 5-point Likert-type scale (1=strongly disagree to 5=strongly agree) to rate how much they agreed that certain outcomes would happen such as “sleep better” or “fit into my clothes better” and how much value they put on these outcome expectations (1=it will not matter at all to 5=it will matter very much).

### **Intervention development and delivery**

Both the intervention and control weight loss programs were developed specifically to help overweight college freshmen lose weight and included the same eating and physical activity plan. Participants in both groups received identical health related information that included exercise and eating plans, strategies to maintain the plans, and expert advice on weight loss. In both programs, nutrition information incorporated nutritional guidelines set by the USDA 2005 Guidelines as a foundation of the program and also included many suggestions provided by the National Weight Control Registry (49). As recommended in a recent review of literature, all participants were encouraged to eat three well-balanced meals from complex carbohydrates, vegetables and low-fat proteins and three snacks made up of a protein and carbohydrate each day

(50). An example would include a glass of fat free milk and an apple for an afternoon snack. Participants were provided with the tools to create a 12-week workout program suited towards working out in their dormitories or geared towards the university fitness faculties. Each program also encouraged participants to select a workout option that was reflective of their current health and fitness status.

To deal with the issue of different fitness levels, participants had the option of selecting the appropriate exercise level for themselves: foundation, intermediate, or advanced PA program. These levels were distinguished by the frequency, intensity, duration, and type of activities promoted. Each level of the program offered a variety of PA options that were feasible in a college setting. Students in the program were encouraged to choose the fitness option that was most reflective of their current level of health and fitness. They had the option of advancing to the next fitness level anytime throughout the program when they felt ready. To avoid injury, all participants were encouraged to spend the first and last 2 minutes of their cardio work-out for warming-up and cooling-down.

#### *Fit Freshmen Program.*

Participants in Fit Freshmen attended a brief introductory session with one of the graduate research assistants where each participant registered online and went through a tutorial explaining how to use the program. Participants received daily e-mail support, access to a comprehensive web site with educational and skill related information, and monthly monetary incentives. Body weight could be tracked weekly via weigh-ins on a weigh-station located in an academic building on campus. The weigh-station data, which included body weight and a photograph of the participant, were uploaded to the intervention website so students could track their progress over the course of the program. In addition to providing motivation through

capturing participant successes, the camera provided a validation check to ensure that participants did not artificially alter their weight, for example, by leaning on the desk. To protect participant information all data was encrypted.

At the end of each month during the intervention period participants who lost 1-5% of their initial body weight received \$5, those that lost 5.1-10% received \$10 and so on. For those participants who lost weight (as compared to baseline) at each time point, the potential to increase monetary incentives was based on weekly completions of weigh-ins and self-monitoring. Participants who lost weight each month and weighed in at least once a week for a month received an additional \$5. Participants who completed their weekly self monitoring online for a given month also received an additional \$5.

Participants received daily emails to support increased physical activity and healthful eating. The content of the daily emails was targeted to a college-aged population and explicitly included strategies to improve self-efficacy and self-regulation (11, 12, 51). Each day of the week had a specific focus on issues that would be relevant to college students in order to sustain healthful weight habits and aligned with SCT constructs (52). Daily topics began with a success story (Sunday), exercise opportunities (Monday), nutrition information (Tuesdays), barriers and strategies to overcome them (Wednesdays), ask the expert (Thursdays), portion size strategies (Fridays), and goals (Saturdays). Additionally, there was a consistent SCT theme for each of the 12 weeks of the program. The 12 weeks were outlined as follows: (1) welcome/confronting myths, (2) expectancy (values, why it's important to lose weight, etc.), (3) self efficacy, (4) time management, (5) reinforcements, (6) environmental, relapsing/Spring Break, (7) social networks, (8) self control, (9) media, (10) emotional coping response, (11) sustaining changes, and (12) reproduction (putting newly acquired knowledge into practice).

Participants in the Fit Freshmen program were taught self-regulatory behaviors relevant to weight management through habitual emails such as “Ask the Expert” focusing on knowledge of benefits and risks of different health behaviors. The weekly Success Stories of other college freshmen who had succeeded in losing weight emphasized observational learning and contributed to participants in the Fit Freshmen program feeling a sense of personal efficacy influenced by vicarious experiences modeled by relevant peers (51). Barriers faced by young adults in an academic setting were targeted once a week in order to address reciprocal determinism on an individual’s actions, specifically one’s environment. On days focusing on goals, short and long-term goal setting were emphasized and focused on how habit changes were in the participants’ best self-interest and represented their outcome expectations as past literature has shown (11). Additionally, each participant in the intervention was provided with a hotline for support known as an internet “health coach” and access to the research team. Potential dietary strategies emphasized in each email included sample menus stressing the importance of fruit and vegetable consumption and low-fat food options. Serving sizes were emphasized by ‘rule of thumb’ and a pictorial of the “plate method.” Specifically, a serving of protein at a meal was defined as the size of the palm of one’s hand while a serving of fruit or vegetables was defined as equitable to the size of the participant’s clenched fist. The “plate method” emphasized that at each main meal, students should try to fill  $\frac{1}{4}$  of their plate with a starchy carbohydrate,  $\frac{1}{4}$  of their plate with a serving of protein and the rest of the plate should be full of non-starchy vegetables. In addition, every Wednesday, nutrition emails addressed certain social cognitive variables dealing with different nutritional aspects such as frequent self-monitoring of intake, methods to avoid overeating in buffet style student dining centers and emotional coping strategies other than

binge eating when stressed. There were also links included throughout the weekly emails to Virginia Tech Dining Services online nutrient information.

### Control.

The control group received two electronic emails, one at the initial start of the study and one six weeks into the study. The newsletters highlighted messages about a healthy lifestyle similar to those messages highlighted in the intervention group. The key difference between the newsletters delivered to the control group and the daily emails delivered to the intervention group was the newsletters focused more on general information that could be found from any validated health source via Internet, whereas the daily emails dealt with social cognitive barriers college students faced in practicing these health tips. Also, the control group lacked a structured social support system to communicate with during the intervention.

### **Focus Groups**

Qualitative data was collected through 3 focus groups of randomly selected intervention group participants to develop rich information on the structure and design of the intervention and to provide directions for future refinements. Students were ineligible to participate in future focus groups after participating in one in order to give each student in the intervention an equal opportunity to share their perceptions on the content and structure of the program. The focus groups were strategically conducted after the initial week of the intervention, at the midpoint and during the last week of the intervention in order to give immediate feedback of the program so problems could be identified and adjusted as the program further progressed. Each semi-structured focus group lasted one hour. Using recommended guidelines, a focus group sample size between four and five was used (53). We used a standard protocol of developing focus

group questions: (1) brainstorming; (2) phrasing the questions; (3) sequencing the questions; (4) estimating time for questions; (5) getting feedback from others; and (6) testing the questions (53). Questions were developed by reviewing the purpose of the study (to create an effective weight loss program for overweight college freshmen) and the intended audience. All scientific jargon was removed from questions and questions were phrased in an open-ended matter in order to generate lively discussion between participants. Questions were developed by one of the senior researchers and then sent to two graduate research assistants to get feedback on the questions. On reviewing the recommended questions, the graduate assistants made sure they understood the questions and that the questions flowed from one topic to the next. Additionally, because the graduate assistants were close in age to the participants, they made sure the words used in the questions were words that participants would use to talk about the intervention.

According to Krueger and Casey (53), focus groups can be used to enhance program development by helping to gain understanding through the perspective of the target audience. First-phase focus groups can be used to design future models with varying intensities, duration and so forth (53). Maximum variation sampling was used Maximum variation sampling in order to get a balance perspective of the Fit Freshmen intervention at each focus group. According to Patton (54), maximum variation sampling is used in order to incorporate a wide variety of participants in order to have a better representation of the general population one is targeting. Although our sample population is primarily Caucasian females, different races and genders from the Fit Freshmen intervention were incorporated into each focus group. All interactions were conducted by one investigator, with a second investigator present to observe and take notes. At the end of the focus group, the investigator verified the data collected by summarizing key points from the discussion and asking participants if there was anything else they would like to

include. Upon participant authorization, the sessions were recorded using a digital voice recorder and written transcripts were generated through a computer software program, Transana. In order to ensure credibility, senior researchers continuously engaged in the transcribing and coding process. The coding process used an inductive method to allow for exploration and discovery of new themes and strategies for interventions.

### **Data Analysis**

Quantitative statistical analysis was conducted using SPSS statistical analysis software (SPSS v.12.0 for Windows). Analyses included descriptive statistics (means, standard error, and frequencies) and repeated ANOVA measurements. Multivariate, repeated measure analysis of covariance using a 2 group randomized controlled trial design tested for treatment effect (i.e. weight loss and percent body fat lost) while accounting for baseline values. Bivariate correlations were used to determine the relationships between changes in social cognitive variables, physical activity, dietary intake, and weight loss. Due to the sample size and pilot nature of this trial, we set an a priori level of significance at  $p < .10$ . Qualitative data was transcribed and reduced to meaning units using both an inductive and deductive approach. Meaning units were organized into the themes associated with different components of the Fit Freshmen content and structure. To identify themes and patterns from focus group data, a graduate research assistant as well as senior investigators developed classification codes during the analysis of data. These codes were obtained from the research questions used during the focus groups as well as key words that constantly appeared in the text from conversations between participants during the analysis of the focus groups. For example, the Fit Freshmen intervention revolved around a meal plan, exercise plan, self-monitoring and self-regulation skills through the use of a weigh-in station and

regular journaling, as well as daily emails. Thus, codes were developed around these components of the intervention when analyzing the data from the focus groups. Every time words or phrases related to these concepts appeared in the text of the participants, sentences or paragraphs containing them were bracketed and the code written next to the bracket according to standard procedures (55). In this way, during the first phase of qualitative analysis, text was organized based on the codes. In addition, codes were derived from a method called constant comparison used to analyze qualitative data (56). In this approach, we used newly gathered data from the second and third focus group and continually compared this data with previously collected data from the first focus group and its coding in order to refine the development of new theoretical categories.

## CHAPTER 4

### Results

The baseline characteristics are provided in Table 1. No baseline differences existed between participants in the control or intervention. Forty-eight percent of the sample was obese. Although participants in the Fit Freshmen arm at baseline were heavier, this is not a statistically significant difference between groups. In regards to the Fit Freshmen intervention participants, participants opened 67.5% of the intervention emails throughout the study. Rates ranged from 79.3% in the first week to 67.5% in the final week. Our primary outcome analysis on weight demonstrated a time by condition main effect at the completion of the study ( $F(1,25) = 3.941, p < 0.1$ ). Specifically, participants in the Fit Freshmen group had significant decreases in body weight at 3 months (mean weight change  $-1.2 \pm 5.1$  kg) when compared with participants in the control group who gained weight at 3 months ( $1.0 \pm 5.0$  kg). Further, changes at 3 months in the potential SCT mediators indicated that participants in the Fit Freshmen intervention differed significantly when compared to the control group in self-regulatory skills related to portion sizes ( $F(1,25) = 6.58, p < 0.1$ ), planning and tracking ( $F(1,25) = 9.427, p < 0.01$ ), fruits and vegetables ( $F(1,25) = 16.890, p < 0.01$ ) and PA ( $F(1,25) = 8.924, p < 0.01$ ). In addition, the Fit Freshmen group differed significantly in the psychosocial mediators “Self-Efficacy to Integrate Physical Activity into Daily Life” ( $F(1,24) = 6.916, p < 0.1$ ) and “Regulating Self-Efficacy to Overcome Barriers to Physical Activity” ( $F(1,24) = 7.332, p < 0.1$ ) in comparison to the control. At the end of the study, Fit Freshmen participants had significant increases in planning and tracking self-regulatory skills ( $1.34 \pm 0.57$ ) when compared to the control ( $0.71 \pm 0.49$ ). Across the intervention period, Fit Freshmen significantly increased self-regulatory skills related to portion sizes ( $1.25 \pm 0.89$ ), fruits and vegetables ( $1.08 \pm 1.00$ ) and PA ( $1.16 \pm 0.67$ ) while the control group only

increased self-regulatory skills in portion sizes ( $0.55 \pm 0.49$ ), and PA ( $0.34 \pm 0.79$ ) and showed a decrease in regards to fruit and vegetable self-regulatory skills ( $-0.18 \pm 0.54$ ). Self-efficacy related to daily PA and overcoming barriers to PA significantly increased in Fit Freshmen participants ( $5.38 \pm 13.62, 12.97 \pm 15.23$ ) while these proposed mediators decreased in the control ( $-3.34 \pm 8.86, -7.95 \pm 14.67$ ).

### **Dietary Behaviors**

At the end of the intervention, the Fit Freshmen subjects reported consuming significantly fewer kcal/day than at baseline ( $-673.46 \pm 521.68$  kcal/day) compared to what the control subjects reported consuming ( $-334.25 \pm 348.45$  kcal/day) ( $F(1,23) = 3.589, p < 0.1$ ). The changes in energy consumption reported by the intervention and control groups corresponded to changes in fat intake ( $F(1,23) = 6.636, p < 0.1$ ). Total protein and carbohydrate intake also decreased in both groups. However, only percentage total protein intake ( $F(1,23) = 5.416, p < 0.1$ ) and percentage total fat intake ( $F(1,23) = 6.716, p < 0.1$ ) were significantly different between groups. Specifically, Fit Freshmen reduced their fat intake and percentage fat intake by a mean  $-36.56 \pm 22.34$  grams and  $-6.09 \pm 5.80\%$ . Reduction in total added sugars was significantly greater in the Fit Freshmen group ( $-40.59 \pm 32.23$  grams) than the control ( $-12.73 \pm 32.09$  grams) ( $F(1,23) = 4.683, p < 0.1$ ).

### **Physical Activity Behaviors**

Amount of vigorous PA and strength training increased in both Fit Freshmen ( $34.58 \pm 122.17$  minutes/day;  $20.42 \pm 52.11$  minutes/day) and control from baseline to the end of the intervention ( $41.54 \pm 119.10$  minutes/day;  $21.15 \pm 95.79$  minutes/day). However, differences between groups were not statistically significant ( $F(1,23) = 0.021, p > 0.1$ ;  $F(1,23) = 0.001,$

$p>0.1$ ). Moderate PA increased across the intervention in the Fit Freshmen group ( $40.00\pm 53.94$  minutes/day) and decreased in the control condition ( $-131.54\pm 719.88$  minutes/day), but these differences were not statistically significant ( $F(1,23) = 0.676, p>0.1$ ).

### **Diet and Physical Activity Social Cognitive Related Constructs**

Table 3 includes the Pearson correlations between physical activity, eating, weight loss, and SCT constructs. There was no clear pattern of relationships that emerged. For example only self-efficacy for overcoming physical activity barriers ( $r=.38$ ) was significantly related to weight loss. Energy intake was significantly correlated with positive outcome expectations related to fruit intake ( $r=.36$ ) and, somewhat surprisingly, to self-regulation for physical activity ( $r=.45$ ) and positive outcome expectations for physical activity ( $r=.34$ ). In terms of physical activity, the only significant relationship that emerged was between strength training and self regulation for physical activity ( $r=.40$ ).

### **Qualitative Analysis**

Participation in the 3 focus group formats was similar; all 13 subjects in the Fit Freshmen group participated in one of the 3 semi-structured focus groups (4,4,5 per group). Themes that emerged were similar across all 3 focus groups suggesting that saturation was reached. The first theme that arose was one related to common time, financial and accessibility barriers to following a dietary plan that included 5 to 6 smaller meals spread throughout the day. Participants generally felt that eating 5 to 6 meals a day as a college freshman living on campus was not a feasible part of the intervention due to lack of time. Further, students found it difficult to adhere to the daily recommended meal plans because of the lack of accessibility of certain

foods offered at campus dining halls, inability to cook their own meals, and lack of money to buy healthy foods. Some examples of participants' responses included:

*I did not like it (recommended meal plan) because it would recommend things such as lightly grilled salmon and I have a campus meal plan!*

*I don't have that much money to afford (foods) recommended on the grocery list.*

*I don't really go grocery shopping so and there's not really a place on campus to just get celery sticks or carrot sticks or that healthy snack that they would want you to eat in between (meals) so you know I try to get those things if I am able to go to a store.*

An addition, barrier to adhering to 6 small meals a day was a lack of social support from friends and the difficulty of following in the plan when friends were eating what they wanted during meal times. Still some participants found value in the meal plan for self-regulatory reasons (e.g., *It made me more aware of what to eat and what not to eat and how much. It really helped me focus on my portion (size) more than anything*).

Participants from each focus group expressed approval and likability for the exercise component of the program. Students felt it was flexible, easy to fit into a college student's schedule, offered a wide variety of options including a gym and dorm option, and different types of levels (e.g., *The thing about the program is it gives us directions and you can do it at your own pace and in your own time*). Participants responded positively to the exercise plan in all aspects and only felt that lack of time when studying for tests was a drawback. Additionally, students expressed a desire for facilitating a more face-to-face social support system to encourage participation in physical activity.

*I think it would be kind of cool if the program incorporated a meeting time with a couple of group members to go to the gym.*

*It would be great to do this with people who are doing the same program as you*  
*If it (group interaction) were to be consistent throughout the program, it could only help.*  
*It would only motivate you more because you would be like "O I have to go meet up and*  
*go workout.""*

Although all focus group participants responded positively to the modest monetary incentives, participants revealed that different formats of incentives related to weight loss would be more relevant to the college student population. For example, themes related to enhancement of monetary incentives included social support and small competitions between similar peers (e.g., *If there was some type of competition between a group of 50 or smaller (participants), people would be more inclined to lose weight. Like the top weight loss for the week gets a gift card to Blockbuster or something or the top weight loss over the whole program gets a 25 dollar gift certificate to some place. It's just that people by nature are competitive and they want to do better than anyone else.*) Overall, students found the small monetary incentives related to weight loss to be an attractive component of the program (e.g., *The fact that I can get paid just to lose weight is priceless and I love that system*). Focus group themes revealed that small financial incentives can be used as an external motivator when adopting habitual weight loss habits into one's life such as regular weigh-ins. (e.g., *I think it (money) helps a little bit. If you don't feel like going across campus to weigh in on a Friday afternoon, I remind myself "If I do this, I will get 5 dollars at the end."*). They did not feel however that the incentives affected their internal motivation to participate in the program.

With regards to email topics, students felt success stories helped increase their own self-efficacy with adhering to the program (e.g., *The success stories and interviews are more motivating than the barrier emails cuz you see somebody else that looks like you is doing the*

*same thing you are and they are succeeding at it so I know I can do it but it's going to be awhile.*). They also liked emails with specific food recommendations on campus (e.g., *I know the one email that had the food suggestions was really good about actual places on campus to eat*). Further, students expressed that emails focusing on self-regulatory skills such as portion control was positive aspect of the program (e.g., *there was one (email) about looking at your plate in four sections... two vegetables and a protein and a starch or carb. That one really set a visual in my mind and when I eat now I always picture dividing my plate into four sections.*) However, in relation to the frequency of emails, students preferred to only receive emails once a week rather than daily. In terms of increasing motivation and self-efficacy, students felt the need for human interaction in the form of small group activities or competitions. Participants also indicated the kiosk was a positive addition to the program, though one theme that was derived from the data included having the kiosk or kiosks more evenly spread around campus to enhance access.

## CHAPTER 5

### Discussion

This study examined the effects of a short-term Internet and incentive-based behavioral weight loss program on a college-aged population. The primary aim of this intervention was to determine if an Internet and incentive-based behavioral weight loss program would produce significant weight loss over a 3-month period in comparison to a control group receiving 2 general health newsletters. Our findings supported our hypothesis in that participants in the Fit Freshmen group had significant decreases in body weight at 3 months when compared with weight gain in controls. The magnitude of this effect was small, but still demonstrates that a weight loss program that includes a behavioral component specifically focusing on social cognitive constructs as well as small monetary incentives can be effective in changing health related behavior, and increased weight loss in an overweight college freshmen population.

Outcomes from our study align with prior findings from other Internet behavioral programs focusing on weight loss (16, 57, 58). Similar to our study, Tate et al. (57) delivered daily and weekly emails enforcing self-monitoring and self-regulatory skills as well as social support from a counselor via the Internet. In addition, participants received weekly e-mail reminders to submit his/her weight. Although Tate and colleagues (57) observed greater weight loss in the intervention and control group (-4.4 kg and -2.0 kg) in comparison to our study, outcome measures differed in that their study took place over a 12 month period. Also, adults had an initial higher mean BMI than our subjects and the control group was more invasive, proactive, and intensive than our control. Even though we did not observe as great of a weight loss as Tate in our current study, we still did observe a significant decrease in weight loss in

comparison to the control, suggesting that a more frequent behavioral email weight loss intervention can have a greater impact in this population in comparison to basic health information delivered through the Internet.

Our pilot RCT study incorporated self-regulatory skills shown to be relevant to a college population (11) as well as self-monitoring skills through encouragement of weekly weigh-ins at a kiosk and additional monetary incentives. In a systematic review of Internet weight loss programs conducted in children and adolescents (16), RCT studies that had email-counseling and emphasized a behavioral component demonstrated significant decreases in BMI compared to the control group. Results from this review demonstrated the potential for behavior change programs on weight loss via the Internet (16). Additionally, the small sample size and homogenous population of female teens align with the predominantly female population (Table 1, 76% female) used in this study.

Lastly, a review of literature conducted by Winett and colleagues (58) that compared the efficacy of SCT-based, Internet weight-loss programs concluded that theoretically based tailored programs delivered via Internet: 1) increase the frequency of contact; 2) make programs more tailored and interactive; 3) focus more on physical activity and changes in eating, 4) maintain motivation long-term and have potential to engage large groups of people and be effective in weight loss and prevention of weight gain. Again, this suggests that perhaps a higher intensity Internet intervention could lead to a larger magnitude of effect. However, it is important to note that the control group gained approximately the amount of weight that would be projected during the second half of a freshmen year in college (3, 25). Further, a more intensive intervention may not have been as strong a fit with the lifestyle of college freshmen.

Although the previous studies are not based on a college-age population, the recommendations and results from these studies match qualitative findings from other studies using a college student population (11, 14). To further support the results observed from this study, the current trend of Internet users tends to be younger, Caucasian, better educated, with higher incomes, and from suburban or urban areas (59). Despite the limitations between comparing differences in populations and study designs from past literature, weight changes that were observed in the Fit freshmen intervention could be attributed to a greater frequency through email contact, incorporation of a virtual mastery-counselor component and Social Cognitive constructs that have been revealed through interviews as relevant to college students. Further to align with recommendations made by Winett and colleagues (58), our study included a mastery component as well as a relapse and long-term maintenance component in the active intervention.

We found a number of significant relationships between an Internet, incentive-based behavioral weight loss program for overweight college students and targeted psychosocial mediators of PA and nutrition behavior/dietary intake. Based on the past literature, we assumed that a behavioral weight loss program delivered via Internet would significantly improve targeted psychosocial mediators related to PA and nutrition behavior in comparison to a control. The findings of this study did support these postulations in that the intervention strategies were successful at changing self-regulatory skills related to portion size, planning and tracking, fruits and vegetables, and PA. According to findings from Strong et al., first and second year college students rarely use dietary strategies to regulate portion size, track food intake or eat more fiber, fruits and vegetables (11). However, results from this same study showed that an increase in behavioral skills such as planning and tracking were correlated with lower energy intake and increased fruit and vegetable consumption (11). Further, a qualitative study conducted by

Greaney and colleagues (12), revealed that college students, regardless of sex, felt that regulating food intake, which was done by “eating in moderation,” “watching portion size,” and not exceeding a “daily calorie limit,” enabled them to maintain a healthful weight. Thus, in our study, significant improvements in these specific psychosocial mediators were seen when compared to the control.

We did not observe significant improvements in other psychosocial mediators such as positive and negative outcome expectations related to fruit and vegetable intake and daily PA when making comparisons between groups over the 3-month period. This contradicts past findings about outcome expectations related to healthful behaviors, weight loss and weight maintenance in college students (11). Although the Fit Freshmen intervention did slightly improve in psychosocial mediators related to PA and nutrition behavior, due to our small sample size and the variability typically associated with psychosocial measures and self-reported methods to assess physical activity and dietary intake behavior change, it may have been difficult to produce significant changes. Further, dietary efficacy for *planning and tracking fruit and vegetable intake* did not significantly improve in the Fit Freshmen intervention compared to the control. When referencing past literature, this may not be surprising. According to Strong et al. (11), college students have a higher dietary efficacy for *decreasing fat* and *reducing Sugar* than for *planning and tracking*. The authors suggested that this specific population may need additional training in behavioral skills related to planning and regulating intake of healthful foods (11). This suggests that the short time frame of our pilot RCT may not be enough time for this segment of the population to fully develop these behavioral skills. Additional feedback from our focus group data also revealed that students felt that there was a lack of accessibility for healthful foods at campus dining halls and they had a lack of money to spend extra money to buy

these foods at local grocery stores. Thus, findings from Strong et al. (11) as well as qualitative feedback from our study suggests that in order to increase self-efficacy for planning and tracking fruits and vegetables, availability and frequency/intensity of development of skills for this population need to be taken into consideration.

For our secondary aim, the effects of the Internet and incentives-based behavioral weight loss program on physical activity and dietary intake, we postulated that because our Fit Freshmen intervention specifically targeted physical activity and dietary intake social cognitions and self-regulatory strategies derived from social cognitive theory shown relevant to this target population, that there would be significant improvements in dietary intake and physical activity in the Fit Freshmen participants in comparison to the control. At the end of the intervention, the Fit Freshmen subjects reported consuming significantly fewer kcal/day than at baseline compared to what the control subjects reported consuming corresponding to changes in fat intake, percent fat intake and percent protein intake. Past findings related to energy consumption and this targeted population is equivocal and contradictory. For example, Hivert et al. (14) conducted an educational and behavioral intervention that was successful in preventing weight gain in first and second year college students. However, when compared to the control, they did not observe any significant differences between total energy intake between baseline and post-intervention (14). Thus, the authors concluded that the small sample size and possibility of underreporting in self-reported food diaries may have been a limitation to their study and did not allow a sufficient power to detect a significant change in energy and macronutrient intake (14). Further, most of the participants in Hivert's study were considered a normal weight. Thus, their findings may not be transferable to our targeted population, all overweight and obese freshmen students.

Other observational studies on trends in weight gain and energy intake in college students are consistent with the findings from our study. In a study conducted by Strong et al. (11), students reported consuming similar daily energy intakes and percent fat and protein intake as our participants at baseline. Further, Strong et al. reported that college students had a higher dietary efficacy to decrease the amount of added sugar and fat in their diet (11). Thus, we can assume that we would see a significant effect in our behavioral intervention that specifically targeted an increase in dietary efficacy related to reducing calories and fat. Baseline energy consumption from added sugar was also similar to results observed by Strong et al. (11). Thus, by specifically targeting improvements in dietary efficacy in relation to portion control and these specific nutrients in our Fit Freshmen intervention, we can assume that we were effective in causing a decrease in the amount of added sugar in one's diet.

In regards to self-reported measures of moderate and vigorous PA, our baseline and post-intervention results contradict past literature on observations of college students' daily PA (60, 61). Butler et al. observed a significant decrease in PA and increase in weight from the start of college to 5 months into college in female freshmen students (60). Still, it is hard to compare these findings with our current findings because our population was already categorized as obese and had been in college for over 4 months before starting our intervention. It should also be noted that participants in the study conducted by Butler and colleagues had a mean BMI of 23.31 and a mean percentage body fat of 21.87 (60). These are considered within a healthy range and are much lower than the mean BMI and percentage body fat of participants in our study. Since our population is primarily obese, we can assume that they may have already been more inactive than a normal, healthy college population, therefore results from Butler et al. may not be transferable to our study.

We assumed that we would not observe significant relationships between changes in proposed psychosocial mediators, physical activity & dietary intake, and weight loss because of equivocal findings from past literature of these relationships. Additionally, due to the small sample size of our current study, we knew it would be difficult to detect significant relationships between behaviors, social cognitions, and weight changes. The literature related to SCT constructs and college students of a normal BMI (11) has shown that students believe that they have the ability to increase their PA levels if needed and when provided the right tools and information to eat healthfully, they will have the ability to have a more well-rounded diet (11). Thus, by incorporating the SCT *self-efficacy* into our active intervention, we can assume this would have a positive effect on an inactive obese college population to believe that they have the ability to increase PA levels as shown in our results. We observed a correlation between decreased energy intake and positive outcome expectations related to fruit intake. According to past literature examining successful weight loss in adults, incorporating dietary strategies such as eating low-fat foods and a wide variety of fruits and vegetables is vital to maintaining weight loss for over a year (62, 63). Thus, we can assume that by targeting positive outcome expectations of college students related to fruit intake (i.e. having more energy, feeling better psychologically and better control of weight management (11)) that we would see a decrease energy intake and weight loss in our Fit Freshmen intervention. Although, we did see a correlation between energy intake and positive outcome expectations of fruit and vegetable intake, we did not observe a correlation between weight loss and positive outcome expectations of fruit and vegetable intake. This may have been due to our small sample size not being able to detect any significant correlation. Further, according to Strong et al., students have a higher self-efficacy to incorporate PA regularly and would work out more if they experienced further body

dissatisfaction such as gaining weight or an inability to fit into their clothes (11). This may suggest that college students associate positive outcome expectations of PA more with weight loss in comparison to positive outcome expectations of healthful eating with weight loss. Further, from our results from current focus groups, students felt that healthful foods such as fruits and vegetables were not readily available to them on campus or too expensive to buy at grocery stores. Lastly, energy intake was accounted for through self-reported 4-day food records which are not necessarily an objective measurement. Participants could have possibly under or over-reported energy consumption, thus causing a correlation between energy intake and certain psychosocial mediators, but not necessarily weight loss.

### *Qualitative Data*

Focus group data was used to generate formative feedback on the content and structure of the Internet and incentive weight loss program in order to further adapt this material to be applied to a weight gain prevention study for a wider range of college students including overweight and normal weight students according to BMI standards. The focus groups revealed several themes related to the feasibility and acceptability of the Internet and incentives-based program from the perspective of participants. Major themes included (1) a reduction in recommended number of meals associated with the meal due to time constraints and difficulty adhering to the plan while in a buffet and social dining environment, (2) reduced email frequency to one time per week with a focus on self-regulation strategies and success stories from similar peers, (3) and the need for human interaction such as weekly group activities or incentive-based competitions between peers. The themes most often reported in this study have also been reported in previous studies, for example; according to qualitative feedback from college

students about barriers and enablers to healthful weight management (12), environmental barriers to eating healthy included: (1) time constraints associated with being a student, thus making it difficult to fit in healthy snacks or obtain healthful meals; (2) unhealthy food served at university dining halls, encouraging overeating; (3) lack of access to healthful food such as transportation to a grocery store; and (4) high monetary costs associated with healthy foods. These barriers align with feedback from students in our current study in regards to barriers to adhering to the recommended daily meal plan. This feedback suggests that for future interventions for college students, it is important to make healthful meal suggestions that align to the accessible foods available at campus dining halls and recommend less frequent meals due to the time constraints of being a college student.

Additionally, results from Greaney et al. (12) about time constraints as a student, suggests that weight loss programs that incorporate daily emails may be too time intensive for this population. Programs should aim to incorporate the most relevant behavioral strategies for weight loss for this population in a weekly email. In regards to enablers to healthful weight management strategies in college students, past literature (11, 12) reported that social support from peers encouraged students to be physically active and go to the gym. This supports current findings from our study in regards to regular small group interaction as a social support network. Lastly, all focus group participants from the current study reported that the kiosk was a positive addition to the program and encouraged weekly self-monitoring. According to Butyrn and colleagues (64), successful weight loss members from the National Weight Control Registry who have maintained their weight loss  $\geq 1$  year regularly weighed themselves daily. Along with current feedback from our study, this suggests that in order to successfully lose and maintain

weight loss, interventions should incorporate a weigh station and weighing in on a regular basis to prevent additional weight gain and a relapse into old unhealthy behaviors.

### **Limitations**

Since this was a pilot study only using overweight and obese freshmen students, several limitations should be addressed. The relatively small sample size and short time frame of the intervention with a lack of a follow-up makes it difficult to assess the impact of this intervention on sustained weight loss and weight maintenance in this targeted population. In addition, participants were predominantly white; college freshmen females. This small, homogeneous sample could possibly restrict the generalizability of results because what may have been enablers and barriers to weight loss in this group may not be similar to a more diverse, predominantly male population. Lastly, it should be noted that this intervention may only be effective in similar college environments such as the environment present at Virginia Tech. Students at different college campuses may not have access to an on-campus gym facility, campus dining halls and may not live on campus as incoming freshmen.

## **CHAPTER 6**

### **Conclusions**

The Fit Freshmen intervention has important implications for researchers and the prevention of obesity at a critical age for weight gain. The Fit Freshmen intervention demonstrated that social cognitive theory-based interventions with modest incentives delivered via Internet can significantly decrease weight and improve healthful eating (decreased energy intake, fat intake, and energy from added sugar) as well as increase some psychosocial mediators of PA and nutrition behavior in college students. However, as noted from participant feedback, although the Internet can be an effective medium for delivery of weight loss interventions for college students, the need for human interaction is critical for continued motivation and a sense of self-efficacy. Thus, future programs need to somehow incorporate small group interaction in addition to the Internet component of the intervention. Future studies examining weight loss in overweight freshmen should incorporate a more diverse population and equal ratio of males to females. Further, because each college campus a student attends has a unique environment that may affect an individual's health behaviors, future research is needed to examine different college environments' role on effective theory-based weight loss programs for a college population. In addition, students used in our current study may have been obese when initially entering college. Thus, reasons behind weight gain may not be similar nor transferable to other college students who tend to gain 2 to 4 kg within their first year of college (3). Hence, studies should aim to recruit college students for similar interventions when initially entering college and also incorporate a broader weight range of students and not just obese students. Lastly, maintenance and follow-up data of these interventions is vital in order to

understand the long-term effectiveness of these interventions on sustained weight loss and maintenance in this targeted population.

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Table 1. Baseline characteristics by condition.

	Total Sample (n=29)	Fit Freshmen (n=14)	Control (n=15)
Age	18.5 (0.6)	18.8 (0.6)	18.1 (0.4)
Gender, Percent female	76	71%	80%
Race			
Caucasian	79%	71%	87%
African American	3%	7%	0%
Asian	10%	14%	7%
American Indian	3%	7%	0%
Ethnicity			
Latino	10%	7%	14%
Height (inches)	67.0 (2.72)	66.6 (2.28)	67.5 (3.1)
Weight (pounds)	198.7 (40.5)	201.5 (42.8)	196.0 (39.6)
BMI	30.97 (5.2)	31.9 (6.3)	30.1 (4.0)
EAT-26 Score	8.6 (5.9)	10.5 (6.2)	6.7 (5.3)

Table 2. Quantitative Outcomes of Fit Freshmen Pilot RCT

Item	Control Group			Fit Freshmen Group			Time by condition	Time by condition
	M T1 (SD)	M T2 (SD)	Δ T2 – T1	M T1 (SD)	M T2 (SD)	Δ T2 – T1	F	<i>p</i>
Energy	2170.17 (154.07)	1835.92 (149.29)	-334.25	2224.15 (148.03)	1550.69 (143.44)	-673.46	3.589	0.071*
Total fat (grams)	87.73 (7.64)	72.92 (6.90)	-14.81	90.03 (7.34)	53.47 (6.63)	-36.56	6.636	0.017*
Total Carbohydrates (grams)	265.23 (20.02)	231.93 (18.73)	-33.30	275.93 (19.23)	202.79 (18.00)	-73.14	2.628	0.119
Total protein (grams)	83.27 (6.25)	69.63 (6.80)	-13.64	84.30 (6.00)	71.89 (6.53)	-12.41	0.021	0.885
Total alcohol (grams)	0.08 (0.03)	0.03 (0.72)	-0.05	0.08 (0.03)	0.98 (0.69)	0.9	0.902	0.352
% Fat Intake	36.47 (1.40)	35.63 (1.72)	-0.84	35.94 (1.35)	29.85 (1.65)	-6.09	6.716	0.016*
% Carbohydrate Intake	48.65 (1.59)	50.39 (1.85)	1.74	50.06 (1.53)	53.38 (1.77)	3.32	0.534	0.472
% Protein Intake	15.83 (0.70)	15.34 (0.73)	-0.49	15.27 (0.67)	17.76 (0.70)	2.49	5.416	0.029*
% Alcohol Intake	0.03 (0.01)	0.00 (0.20)	-0.03	0.02 (0.01)	0.26 (0.19)	0.24	0.976	0.334
Total Cholesterol Intake (grams)	343.39 (52.67)	222.38 (23.68)	-121.01	325.36 (48.45)	175.90 (21.79)	-149.46	0.150	0.702
Total Saturated Fatty Acid Intake (grams)	30.68 (2.65)	23.30 (2.36)	-7.38	29.01 (2.55)	17.62 (2.27)	-11.39	1.445	0.242
Total Monounsaturated Fatty Acid Intake (grams)	31.99 (3.04)	26.70 (2.77)	-5.29	33.24 (2.92)	19.12 (2.66)	-14.12	6.941	0.015*
Total Polyunsaturated Fatty Acid Intake (grams)	17.94 (1.83)	16.95 (1.35)	-0.99	20.36 (1.76)	11.90 (1.29)	-8.46	13.63	0.001*

<b>Item</b>	<b>M T1 (SD)</b>	<b>M T2 (SD)</b>	<b>Δ T2 – T1</b>	<b>M T1 (SD)</b>	<b>M T2 (SD)</b>	<b>Δ T2 – T1</b>	<b>F</b>	<b>P</b>
Total Trans-Fatty Acid Intake (grams)	6.90 (0.83)	5.93 (0.79)	-0.97	6.6 (0.80)	3.90 (0.76)	-2.70	2.166	0.155
Total Omega-3 Fatty Acid Intake (grams)	1.86 (0.16)	1.72 (0.13)	-0.14	1.93 (0.15)	1.19 (0.13)	-0.74	10.023	0.004*
% Saturated Fatty Acid Intake	12.88 (0.60)	11.31 (0.71)	-1.57	11.53 (0.58)	9.87 (0.68)	-1.66	0.009	0.927
% Monounsaturated Fatty Acid Intake	13.30 (0.64)	13.05 (0.69)	-0.25	13.25 (0.62)	10.49 (0.67)	-2.76	7.906	0.01*
% Polyunsaturated Fatty Acid Intake	7.32 (0.46)	8.35 (0.39)	1.03	8.19 (0.44)	6.80 (0.37)	-1.39	12.161	0.002*
Total Added sugars (grams)	75.67 (9.77)	62.94 (6.49)	-12.73	79.61 (9.39)	39.02 (6.24)	-40.59	4.683	0.041*
Total fiber intake (grams)	15.53 (1.37)	15.07 (1.48)	-0.46	15.44 (1.31)	12.37 (1.42)	-3.07	1.331	0.260
Total fiber intake per 1000 kilocalories (grams)	7.10 (0.65)	8.05 (0.64)	0.95	7.31 (0.63)	8.26 (0.62)	0.95	0.000	1.00
Regulating Calories and Fat Self-Efficacy	2.97 (0.18)	3.52 (0.18)	0.55	2.70 (0.19)	3.96 (0.19)	1.26	6.579	0.017*
Planning and Tracking Self-Regulation	2.20 (0.12)	2.92 (0.13)	0.72	2.38 (0.13)	3.72 (0.13)	1.34	9.427	0.005*
Regulating Fruits and Vegetables	3.75 (0.27)	3.57 (0.23)	-0.18	3.12 (0.28)	4.19 (0.23)	1.07	16.890	<0.001*

Self Regulation Keeping Track	83.09 (4.60)	80.29 (4.10)	-2.80	72.62 (4.77)	75.83 (4.26)	3.21	0.816	0.375
Self Regulatory Self-Efficacy Fruits and Vegetables	73.96 (4.20)	76.29 (4.11)	2.33	71.23 (4.36)	72.62 (4.26)	1.39	0.030	0.865
Fruit Positive Outcome Expectancies	4.41 (0.14)	4.48 (0.12)	0.07	4.48 (0.15)	4.59 (0.13)	0.11	0.059	0.811
Fruit Negative Outcome Expectancies	2.50 (0.21)	2.49 (0.24)	-0.01	2.98 (0.22)	3.14 (0.25)	0.16	0.668	0.415
Physical Activity Self Regulation	3.00 (0.24)	3.43 (0.15)	0.43	2.68 (0.25)	3.97 (0.15)	1.29	8.924	0.006*
Self-Efficacy to Integrate Physical Activity into Daily Life	77.29 (3.21)	78.37 (3.44)	1.08	71.21 (3.46)	81.46 (3.71)	10.25	6.916	0.015*
Self-Efficacy to Overcome Barriers to Physical Activity	73.20 (4.26)	70.18 (4.06)	-3.02	61.07 (4.60)	74.23 (4.38)	13.16	7.332	0.012*
Physical Activity Positive Outcome Expectancies	4.14 (0.14)	4.35 (0.14)	0.21	4.15 (0.14)	4.33 (0.14)	0.18	0.049	0.826
Physical Activity Negative Outcome Expectancies	2.40 (0.19)	2.51 (0.20)	0.11	2.34 (0.20)	2.43 (0.21)	0.09	0.011	0.917
Total Weekly Moderate PA	246.15 (137.94)	114.62 (25.60)	-131.53	71.25 (143.57)	111.25 (26.64)	40.00	0.676	0.420
Total Weekly Vigorous PA	121.15 (35.63)	162.69 (48.02)	41.54	87.92 (37.09)	122.50 (49.98)	34.58	0.021	0.887
Total Weekly Strength Training	68.46 (31.71)	89.62 (32.97)	21.16	35.42 (33.00)	55.83 (34.31)	20.41	0.001	0.981

Total Fat Mass (kg)	38.04 (4.61)	39.10 (4.77)	1.06	42.90 (4.79)	42.29 (4.95)	-0.61	3.216	0.085*
Total Lean Mass (kg)	50.56 (3.51)	50.36 (3.40)	-0.20	48.35 (3.64)	47.68 (3.53)	-0.67	0.445	0.511
Body Mass Index	29.54 (1.37)	29.90 (1.40)	0.36	32.33 (1.42)	31.91 (1.45)	-0.42	4.006	0.056*
Waist Circumference (cm)	95.57 (3.79)	96.82 (3.84)	1.25	105.23 (3.94)	104.42 (3.99)	-0.81	2.304	0.142
Body Fat %	38.41 (2.24)	39.43 (2.36)	1.02	42.47 (2.33)	42.15 (2.45)	-0.32	2.203	0.150
Weight (kg)	87.5 (4.90)	88.5 (5.0)	1.00	93.1 (5.10)	91.9 (5.10)	1.20	3.941	0.058*

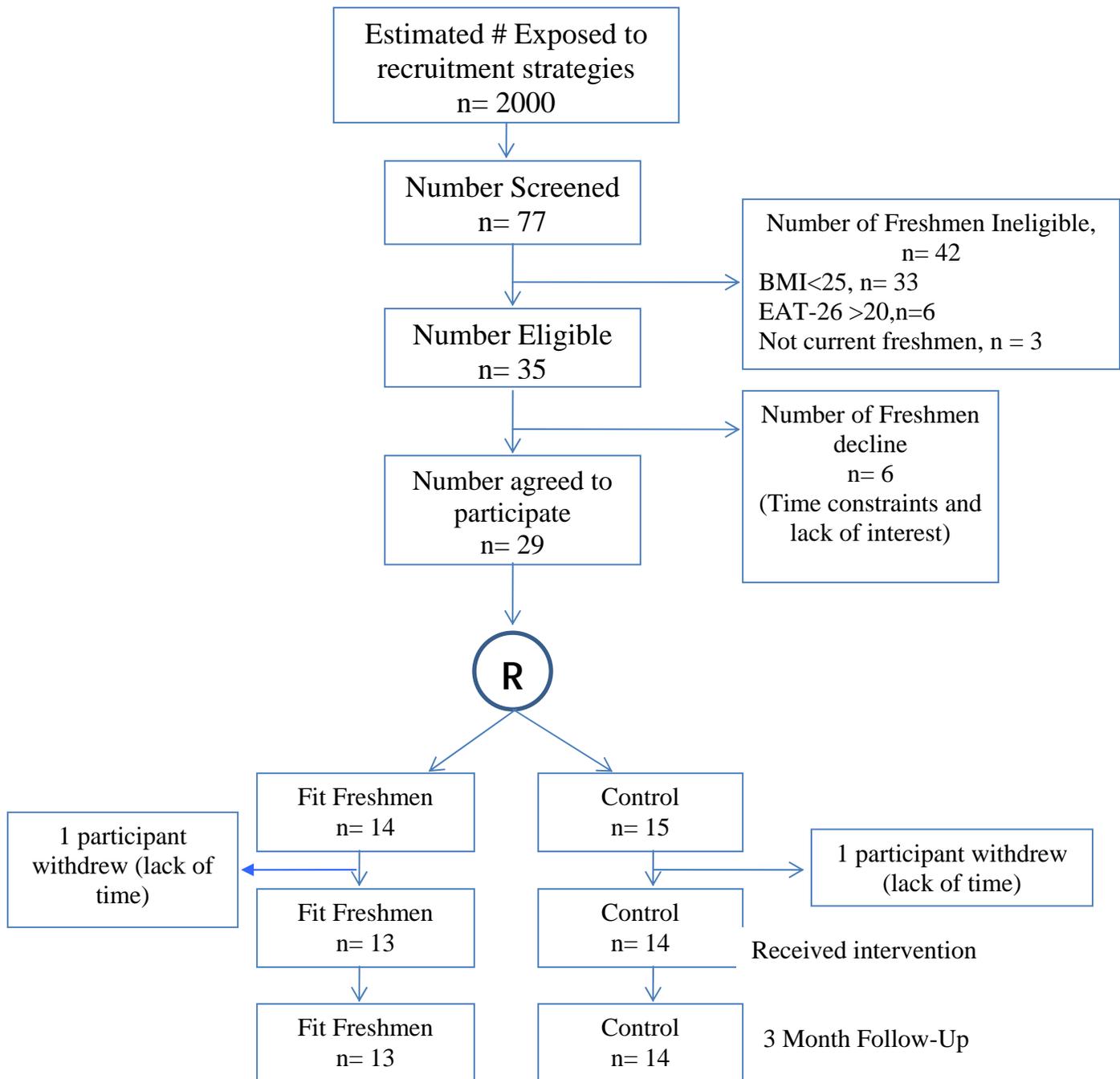
Table 3. Correlations between social cognitive psychosocial mediators, PA, dietary intake, and weight loss

Psychosocial Mediator	Outcome Variable							
	Weight Loss	ΔEnergy Intake	ΔFat Intake	Δ%Fat Intake	ΔAdded Sugar	ΔModerate PA	ΔVigorous PA	ΔStrength Training
Self Regulation – Portion Sizes	-0.083	-0.256	-0.155	0.220	-0.018	-0.171	0.022	0.177
Self Regulation – Planning & Tracking	0.313	0.067	0.032	-0.146	-0.136	0.310	-0.016	0.024
Self Regulation – Fruits & Vegetables	0.303	-0.299	-0.290	-0.217	-0.188	0.056	0.127	0.123
Self Regulation – Keeping Track	0.049	0.309	0.239	-0.081	0.410*	0.166	-0.062	-0.224
Self Regulation – Self Efficacy to eat Fruits & Vegetables	-0.052	-0.050	0.073	0.148	0.285	0.037	0.166	0.175
Positive Outcome Expectations – Fruit & Vegetables	0.106	0.356*	0.255	-0.214	0.310	0.104	-0.003	-0.084
Negative Outcome Expectations – Fruit & Vegetables	-0.195	-0.112	-0.176	-0.103	-0.034	-0.253	-0.033	-0.111
Self Regulation – PA	0.272	-0.450*	-0.508*	-0.391*	-0.598*	0.121	0.092	0.403*
Self Efficacy – Integrating PA daily	0.266	0.029	-0.063	-0.161	0.059	0.143	0.111	-0.048
Self Efficacy – Overcoming Barriers for PA	0.383*	-0.100	-0.213	-0.273	-0.090	0.089	-0.147	-0.102
Positive Outcome Expectations - PA	0.172	0.341*	0.132	-0.430*	0.214	0.088	-0.241	-0.082

<b>Negative Outcome Expectations - PA</b>	<b>-0.020</b>	<b>0.122</b>	<b>0.114</b>	<b>0.084</b>	<b>0.216</b>	<b>0.145</b>	<b>-0.129</b>	<b>-0.274</b>
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\* Denotes significant correlation,  $p < 0.1$

Figure 1. Consort Diagram





**Office of Research Compliance**  
 Institutional Review Board  
 2000 Kraft Drive, Suite 2000 (0497)  
 Blacksburg, Virginia 24061  
 540/231-4991 Fax 540/231-0959  
 e-mail moored@vt.edu  
 www.irb.vt.edu

FWA00000572( expires 1/20/2010)  
 IRB # is IRB00000667

DATE: January 21, 2009

MEMORANDUM

TO: Paul Estabrooks  
 Brenda M. Davy  
 Kevin P. Davy

FROM: David M. Moore 

Approval date: 1/12/2009  
 Continuing Review Due Date: 12/28/2009  
 Expiration Date: 1/11/2010

SUBJECT: **IRB Full IRB Approval:** "Fit Freshman", IRB # 08-793

The above referenced protocol was submitted for full review and approval by the IRB at the January 12, 2009 meeting. The board had voted approval of this proposal contingent upon receipt of responses to questions raised during its deliberation. Following receipt and review of your responses, I, as Chair of the Virginia Tech Institutional Review Board, have, at the direction of the IRB, granted approval for this study for a period of 12 months, effective January 12, 2009.

Approval of your research by the IRB provides the appropriate review as required by federal and state laws regarding human subject research. As an investigator of human subjects, your responsibilities include the following:

1. Report promptly proposed changes in previously approved human subject research activities to the IRB, including changes to your study forms, procedures and investigators, regardless of how minor. The proposed changes must not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the subjects.
2. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.
3. Report promptly to the IRB of the study's closing (i.e., data collecting and data analysis complete at Virginia Tech). If the study is to continue past the expiration date (listed above), investigators must submit a request for continuing review prior to the continuing review due date (listed above). It is the researcher's responsibility to obtain re-approval from the IRB before the study's expiration date.
4. If re-approval is not obtained (unless the study has been reported to the IRB as closed) prior to the expiration date, all activities involving human subjects and data analysis must cease immediately, except where necessary to eliminate apparent immediate hazards to the subjects.

**Important:**

If you are conducting **federally funded non-exempt research**, please send the applicable OSP/grant proposal to the IRB office, once available. OSP funds may not be released until the IRB has compared and found consistent the proposal and related IRB application.

cc: File

**Appendix B**

**Health History Screener**

**Virginia Tech  
Department of Human Nutrition, Foods, and Exercise**

**HEALTH HISTORY QUESTIONNAIRE FOR PARTICIPATION IN FITFRESHMEN STUDY**

SUBJECT ID # \_\_\_\_\_

DATE \_\_\_\_\_

**PLEASE PRINT**

1. **GENERAL DEMOGRAPHIC INFORMATION:** Age: \_\_\_\_\_ Sex: \_\_\_\_\_ Height: \_\_\_\_\_ Weight \_\_\_\_\_

Race

- American Indian or Alaskan Native     Asian or Pacific Islander     Black or African American
- White     Unsure     Other

Please indicate which of the following best describes you (Please choose one.)

- Hispanic or Latino     Not Hispanic or Latino     Not Sure

2. **GENERAL MEDICAL HISTORY**

Do you have any current medical conditions?    YES     NO     If Yes, please explain:

Are you allergic to any medications?    YES     NO     If Yes, please explain:

Have you had any major illnesses in the past?    YES     NO     If Yes, please explain:

Have you ever been hospitalized or had surgery?    YES     NO     If Yes, please explain:  
(include date and type of surgery, if possible)

Are you currently taking any medications or supplements, including aspirin, hormone replacement therapy, or other over-the-counter products?

YES     NO     If Yes, please explain:

<u>Medication/Supplement</u>	<u>Reason</u>	<u>Times taken per Day</u>	<u>Taken for how long?</u>
------------------------------	---------------	----------------------------	----------------------------

Please check yes or no for the following questions:

YES    NO

- 1.   Has your doctor ever said you have heart trouble?
- 2.   Do you frequently have pains in your heart and chest?
- 3.   Do you often feel faint or have spells of severe dizziness?

4.   Has a doctor ever said your blood pressure was too high?

YES NO

5.   Has your doctor ever told you that you have a bone or joint problem such as arthritis that has been aggravated by exercise, or might be made worse with exercise?
6.   Is there a good physical reason not mentioned here why you should not follow an activity program even if you wanted to?

4. **TOBACCO** (check all that apply)

Do you currently smoke? (*Check one.*)

- No, I have never smoked  
 No, I quit within the last 6 months  
 No, I quit more than 6 months ago  
 Yes, I currently smoke

**Current Smokers:**

# per day:

- |                                       |       |
|---------------------------------------|-------|
| <input type="checkbox"/> Cigarettes   | _____ |
| <input type="checkbox"/> Cigar        | _____ |
| <input type="checkbox"/> Pipe         | _____ |
| <input type="checkbox"/> Chew Tobacco | _____ |
| <input type="checkbox"/> Snuff        | _____ |

Total years of tobacco use \_\_\_\_\_

5. **ALCOHOL**

Please answer the questions as honestly and accurately as you can. Remember, your responses are completely confidential and anonymous. **One drink is defined as 12 ounces of beer, 5 ounces of wine, or one standard cocktail (1.5 ounces of 80-proof liquor).**

1. How often do you have a drink containing alcohol per week? \_\_\_\_\_  
 a. If less than once per week, how often do you have a drink containing alcohol per month? \_\_\_\_\_
2. How many *drinks* containing alcohol do you have on a typical day when you are drinking? \_\_\_\_\_

6. **NUTRITIONAL HABITS**

What was your weight 24 months ago? \_\_\_\_\_ 12 months ago? \_\_\_\_\_ 6 months ago? \_\_\_\_\_

Please place an (X) in the column which applies best to each of the numbered statements. All of the results will be strictly confidential. Most of the questions directly relate to food or eating, although other types of questions have been included. Please answer the questions carefully.

	Always	Usually	Often	Sometimes	Rarely	Never
1. Am terrified about being overweight	0	0	0	0	0	0
2. Avoid eating when I am hungry	0	0	0	0	0	0
3. Find myself preoccupied with food	0	0	0	0	0	0
4. Have gone on eating binges where I feel that I may not be able to stop	0	0	0	0	0	0
5. Cut my food into small pieces	0	0	0	0	0	0
6. Aware of the calorie content of foods that I eat	0	0	0	0	0	0
7. Particularly avoid foods with a high carbohydrate content (i.e. bread, rice, potatoes, etc.)	0	0	0	0	0	0
8. Feel that others would prefer if I ate more	0	0	0	0	0	0
9. Vomit after I have eaten	0	0	0	0	0	0
10. Feel extremely guilty after eating	0	0	0	0	0	0
11. Am preoccupied with a desire to be thinner	0	0	0	0	0	0
12. Think about burning up calories when I exercise	0	0	0	0	0	0
13. Other people think that I am too thin	0	0	0	0	0	0
14. Am preoccupied with the thought of having fat on my body	0	0	0	0	0	0
15. Take longer than others to eat my meals	0	0	0	0	0	0
16. Avoid foods with sugar in them	0	0	0	0	0	0
17. Eat diet foods	0	0	0	0	0	0
18. Feel that food controls my life	0	0	0	0	0	0
19. Display self-control around food	0	0	0	0	0	0
20. Feel that others pressure me to eat	0	0	0	0	0	0
21. Give too much time and thought to food	0	0	0	0	0	0
22. Feel uncomfortable after eating sweets	0	0	0	0	0	0
23. Engage in dieting behavior	0	0	0	0	0	0
24. Like my stomach to be empty	0	0	0	0	0	0
25. Enjoy trying new rich foods	0	0	0	0	0	0
26. Have the impulse to vomit after meals	0	0	0	0	0	0

**7. CAMPUS LIVING**

How many credits are you enrolled in? \_\_\_\_\_

**8. EXERCISE**

**How many times per week on average did you do the following kinds of exercise OVER THE PAST MONTH?**

When answering these questions please:

- consider your weekly average over the past month.
- only count exercise sessions that lasted 10 minutes or longer in duration.
- only count exercise that was done during free time (i.e., not occupation or housework).
- note that the main difference between the three categories is the intensity of the exercise.

1. Thinking about MILD EXERCISE (MINIMAL EFFORT, NO PERSPIRATION) (e.g., easy walking, yoga, archery, fishing, bowling, lawn bowling, shuffleboard, horseshoes, golf, snowmobiling)

a. How many times per week do you do MILD EXERCISE? \_\_\_\_\_

b. How many minutes each time? \_\_\_\_\_

2. Thinking about MODERATE EXERCISE (NOT EXHAUSTING, LIGHT PERSPIRATION)  
(e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)
  - a. How many times per week do you do MODERATE EXERCISE? \_\_\_\_\_
  - b. How many minutes each time? \_\_\_\_\_
3. Thinking about STRENUOUS EXERCISE (when your HEART BEATS RAPIDLY, SWEATING)  
(e.g., running, jogging, hockey, soccer, squash, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling, vigorous aerobic dance classes, heavy weight training)
  - a. How many times per week do you do STRENUOUS EXERCISE? \_\_\_\_\_
  - b. How many minutes each time? \_\_\_\_\_
4. Thinking about exercises to increase muscle strength, such as lifting weights or calisthenics.
  - a. How many times per week do you do exercises to increase muscle strength? \_\_\_\_\_
  - b. How many minutes each time? \_\_\_\_\_
5. Thinking about the time you spend sitting at work, at home, while doing course work and during your leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television. Answer to the closest quarter of an hour (e.g., 10.25 hours).
  - a. How many hours do you spend sitting on a typical weekday? \_\_\_\_\_
  - b. How many hours do you spend sitting on a typical weekend day? \_\_\_\_\_

Compared to a year ago, how much regular physical activity do you get?

Much less       Somewhat less       About the same       Somewhat more       Much more

***If your values are out of expected ranges, or if you are pregnant, we will indicate this to you and suggest that you discuss this with your personal physician.***

Reviewer: \_\_\_\_\_  
                    Print Name                      Signature

Date: \_\_\_\_\_

## Appendix C

### Fit Freshmen Focus Group Guide

Introductory Comments: Thanks for coming to our focus group today. Our goal for the day is to get feedback from you on the structure of Fit Freshmen as well as the content. As we go through the questions I will remind you to think about the things you like about the different aspects of the program and things you might consider changing to make it more appropriate for college freshmen.

First, I would like to talk about the exercise and eating plans in the program we'll take about 15 minutes on this topic.

1. What feedback do you have about the exercise plan? Think about the things you like about it and things you might consider changing to make it more appropriate for college freshmen.[Wrap up by 7 minutes]
  - Prompts if necessary:
    - what about the levels beginner, intermediate, advanced?
    - The amount of time needed?
    - Barriers to this exercise plan
    - Things you like about the exercise plan
2. What feedback do you have about the eating plan? What do you like about it and what things might you consider changing to make it more appropriate for college freshmen?  
[Wrap up by 15 minutes]
  - Prompts if necessary:
    - what about the number of meals per day?
    - The alignment of the types of food during each meal and the cafeteria offerings?
    - Barriers to this particular meal plan
    - Things you like about this meal plan

Thanks, next week would like to get feedback on the information and structure of the daily emails and website. We'll take about 20 minutes on this topic.

3. What feedback do you have on the daily emails? What do you like about them and what things might you consider changing to make it more appropriate for college freshmen?  
[Wrap up by 25 minutes]
  - Prompts if necessary:
    - What do you think about the frequency?
    - Are they too long or too short?
    - What do you think about the way the emails are laid out?
    - What do you think about the topics covered?  
Are there any emails so far that you have really found helpful?

4. What feedback do you have on the website? What do you like about it and what things might you consider changing to make it more appropriate for college freshmen? [Wrap up by 35 minutes]
  - Prompts if necessary:
    - What do you think about the fitness profile, motivational features, and your progress report?
    - Do you check your fitness profile often? Has it helped you stay on track?
    - How about the “Ask the Health Coach” feature?
    - Are there more interactive features you would like to see?

Thanks for your responses, now I would like to ask you some more specific questions about the features of the program that help you keep track of and reward your progress—the 60 second journal, the healthspot weigh station, and the incentives for losing weight. We’ll take about 15 minutes on this topic.

5. How do you like the 60 second journal and what things might you consider changing to make it more appropriate for college freshmen? [wrap up by 40 minutes]
6. How do you like the incentives in the program (the amount for weight loss, journaling, and weighing in) and how might you change them to be more motivational? [Wrap up by 45 minutes]?
7. What feedback do you have on the healthspot weigh station? [Wrap up by 50 minutes]?
  - Prompts if necessary:
    - Location?
    - Ease of use?

Thanks again for the discussion, in the last 10 minutes we would like to get a feel for your overall experience with the program, any additional improvements we could make to the program that we haven’t already talked about, and if you have noticed any changes in your health over the first couple of weeks of following the program. So, I will open it up for feedback now.

## Appendix D

### Contamination Between Groups Questionnaire

1. Before this study, how many other participants did you know? \_\_\_\_\_

What were their names? \_\_\_\_\_

2. How many new friends did you make after the start of the study? \_\_\_\_\_

What were their names? \_\_\_\_\_

**Appendix E**

**Fit Freshmen Program Experience Evaluation**

<b>Please indicate your level of agreement. Over the last 3 months...</b>		<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Uncertain (Not Sure)</b>	<b>Agree</b>	<b>Strongly Agree</b>			
1)	The daily emails provided me with valuable information on how to <b>eat more healthfully</b> .	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>			
2)	The daily emails provided me with valuable information on how to <b>be more physically active</b> .	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>			
3)	The online coaching was useful for helping me reach my weight loss goals.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>			
4)	The level of exercise program I chose (Foundation, Intermediate, and Advanced) felt appropriate for my fitness level.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>			
5)	The 60 second journal helped me keep track of what I needed to do to lose weight.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>			
6)	The ‘Ask the Trainer’ option in the program provided useful information.	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>			
7)	What level of exercise program are you currently doing? <input type="checkbox"/> <sub>1</sub> Foundation <input type="checkbox"/> <sub>2</sub> Intermediate <input type="checkbox"/> <sub>3</sub> Advanced <input type="checkbox"/> <sub>4</sub> None								
8)	On average, over the last three months, how many days per week did you stick with your <b>exercise plan</b> ?								
		0	1	2	3	4	5	6	7
9)	On average, over the last three months, how many days per week did you stick with your <b>eating plan</b> ?								
		0	1	2	3	4	5	6	7
<b>On average, over the last three months, how often did you...</b>		<b>Less than once a month</b>	<b>Once a month</b>	<b>Once every two weeks</b>	<b>Once per week</b>	<b>More than once per week</b>			

- 10) Weigh-in at the Health Spot in Wallace? <sub>1</sub> <sub>2</sub> <sub>3</sub> <sub>4</sub> <sub>5</sub>
- 11) Visit the motivation center on the website (where you pictures are stored)? <sub>1</sub> <sub>2</sub> <sub>3</sub> <sub>4</sub> <sub>5</sub>
- 12) Complete the 60 second journal? <sub>1</sub> <sub>2</sub> <sub>3</sub> <sub>4</sub> <sub>5</sub>
- 13) Use the “Ask the trainer” feature of the program? <sub>1</sub> <sub>2</sub> <sub>3</sub> <sub>4</sub> <sub>5</sub>
- 14) Over the last three months have you read the daily emails on most days of the week?  
<sub>1</sub> No <sub>2</sub> Yes
- 15) If NO, when did you stop reading them most days of the week?  
<sub>1</sub> Never read them  
<sub>2</sub> During the 1st month of the program  
<sub>3</sub> During the 2nd month of the program  
<sub>4</sub> During the 3rd month of the program  
<sub>5</sub> Read all of the emails during the program

**Thank you!**  
**You have completed this survey.**

*This form was entered by: (Do not enter.)*

<sub>1</sub> <sub>2</sub> <sub>3</sub> <sub>4</sub> <sub>5</sub> <sub>6</sub> <sub>7</sub> <sub>8</sub>    Reviewed by: